A Behavioural Approach to Kinked Demand Curves

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June 1992

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by

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June 1992

Abstract

The starting point of this paper is the significance for economic theory of the introduction of threshold sensitive behavior which is better known in psychology as the Weber-Fechner Law. It is shown that the incorporation of this Law can give an individual multi-kinked demand curve which can be approximated as a market demand curve of the Sweezy type. In terms of macroeconomic significance, the Law can be connected to income policies, saving behavior and expectations in the money markets.

Special thanks are due to an anonymous referee of this Journal.

1. Introduction

The concept of the kinked demand curve has a long history and presence in microeconomic analysis. In spite of this, not many theorists have seriously considered the subject. For many years, the analysis was confined to the textbook exposition of oligopoly model in which the kinked demand comes from the well-known assumptions about firm's behaviour. Recently the idea of a kinked demand curve has received some renewed attention and some other explanations have been suggested. The most important of these explanations are informational asymmetry, customer loyalty, and product addiction.

In this paper we will suggest an additional reason for the kink which has to do with the behavioural idea of sensitivity thresholds. Although this approach has considerable backing in psychology, and a few economists have attempted a transfer to economics, it has not been connected with the demand curve itself. In addition the paper will discuss some macroeconomic implications of kinked demand curves and also some space will be devoted to possible econometric testing of the kinks.

Thus the paper will start with a discussion of the traditional explanations of the kinked demand curve. The following section will consider the construction of a kinked demand based on the behavioural assumption of psychological sensitivity. Next there will be some discussion of the impact on market demand curves. In the following section, there will be an examination of possible macroeconomic implications and also of a possible method for testing the presence of kinks in demand curves. A concluding section will close the paper.

2. Traditional Explanations of the Kinked Demand

One of the oldest and most popular approach to kinked demand curves is Sweezy's oligopoly model (Sweezy, 1939). The idea of the kinked demand curve is based on the different perception of the firms in imperfect markets. In particular, the upper section of the kinked demand curve has a higher price elasticity than the lower part. This reflects the idea that when firms reduce price other competitor firms will follow, matching the price cut. In case the firm increases its price, the rest will not follow and thus it might loose a considerable number of customers.

A similar approach to the kinked demand is followed by Hall and Hitch. There is an important difference however, in the sense that Hall and Hitch concentrate on why prices are not changed as quantities move back and forward with fluctuations in the trading conditions (Hall and Hitch,1939). On the other hand, Sweezy's approach focuses on why firms may not reduce prices in times of unemployment even when they can reduce factor costs. These two early theories constitute the classic approach to demand curve which relates to the theory of the firm.

Apart from the above, there were other significant attempts to theorize on the issue from an entirely different perspective and namely from the consumer side. Specifically, Scitovsky maintained that consumer habits can cause a downward-pointing kink to the demand curve (Scitovsky, 1978). This is because that once economic agents are exposed to a certain level of consumption, it is hard to abandon that level. Thus the development of a habit implies that agents will resist a substantial cut in the quantity consumed once price has been increased (addiction asymmetry).

Okun offered a similar explanation in his "Prices and Quantities" published in 1981 (Okun, 1981). The assumption here is that of customer loyalty. According to Okun, customers can be divided into those that had previous shopping experience

from a particular firm (repeaters) and those with no such experience (random shoppers). The repeaters are likely to continue buying from the same firm as long as there are no price increases, (or very small increases) and obviously price reductions. However, it is likely that they will shop around when there is a significant price rise. Thus the demand curve of the repeaters will be kinked with the upper segment more elastic than the lower one.

Stiglitz adopted an approach which had to do with informational asymmetries. Lower prices asked for by a supplier may not be fully advertised to customers currently buying from other suppliers who are maintaining the current prices. At the same time a higher price imposed by the same supplier induces present customers to leave in search for other suppliers (Stiglitz, 1979). Thus the upper segment of the demand curve will be more elastic than the lower one. Similar approaches are advocated by Braverman and Negishi (see Braverman, 1980 and Negishi, 1985).

All the above approaches can be used as a justification for a kink in the demand curve. Usually the demand is viewed as having one kink. However, as Hall and Hitch have shown there is the possibility of a multi-kinked demand (Hall and Hitch, 1939). The following section offers an alternative explanation which can also justify kinks.

3. Price Threshold

One could also derive a kinked demand curve if one is willing to incorporate research from psychology. First of all, developments in experimental psychology have cast doubt over the assumption that all agents are perfect utility maximisers and that continuously engage in utility maximization. More specifically, psychologists distinguish between matching and maximising behaviour. In psychological theory matching behaviour implies that the proportion of responses to one alternative will match the proportion of reinforcements provided by that alternative. In other words the

difference between maximization and matching is that in maximimization subjects are maximally happy accross the n activities while in matching subjects are equally happy in each of their n activities. Research has indicated that matching rather than maximizing behaviour is the norm (for a discussion see Prelec, 1982 and Drakopoulos, 1990, 1991).

Furthermore, one can utilize psychophysics and follow one of its basic principles which is that there is a correspondence between physical stimulus and psychological sensations. In the case of demand this implies that the consumer does not modify his or her choices according to every change in price but only when price exceeds a certain limit.

In particular, the Weber-Fechner law in psychophysics suggests that as a physical stimulus increases logarithmically, the sensation quality of that stimulus as perceived by the observer increases arithmetically. This implies that there is a threshold before the subject can detect differences in stimuli. For instance, if one holds a 10 kg weight, it will take an additional 1 kg before the difference is detected (see Osgood, 1953, and Dember and Jenkins, 1970). This has been formalized as follows: if I is the intensity of the stimulus and DI is the change in I then:

$$\frac{\Delta I}{I} = k$$

k is a constant. The fraction Δ/I can be termed as the threshold (see Dember, 1969). In terms of consumer theory price P can be taken as a stimulus, ΔP as the just noticeable difference, and the previous formula becomes:

$$\frac{\Delta P}{P} = k$$

(see also Thaler, 1980).

Stigler, Carlson and Parkin have also discussed this law in economic terms. More specifically Carlson and Parkin use this idea in their analysis of inflationary expectations where they make use of the Weber-Fechner law to price movements (Carlson and Parkink, 1975 and also Stilger, 1965).

However, we can incorporate the ideas of noticeable differences and threshold into consumer theory by formulating a threshold based dynamic demand curve. Following Devletoglou and Demetriou (1967) and Devletoglou (1971) a threshold based demand function can take the form:

$$p_t = p[p_t - g(p_t - p_o), a_t]$$

where

$$g = \left\langle {1 \atop 0} \right\rangle \text{ if } \left| \frac{Pt-P0}{P0} \right| \left\langle {< \atop \geq} \right\rangle \text{AT}$$

g describes the threshold, p_t price at time t, p_o the price of a base year, a_t an exogenous variable, T the time period and A price threshold per unit of time. It is clear that a threshold range of price indifference is implied. When relative price changes are perceived to be small, one expects the response in quantity to be sticky (see Devletoglou, 1971, pp 20-24). Moreover, one expects that the threshold will be wider when the agent perceives the level of prices to be low, and narrow when the level of prices are perceived to be high.

This reaction can be connected with what Thaler calls "Mental Illusions" which implies that the consumer's perceptions of changes are likely to be different from the actual changes. For example a discount might be treated differently from a surcharge (see Thaler, 1980). In addition, some authors have pointed out the importance of frames of reference when agents evaluate movements in prices and incomes. For instance, H. Behrend employs this idea in relation to perceptions of inflation (Behrend, 1964). Related to this point is the use of price ranges as an attention confining device. The consumer might set upper and lower limits in which the good is expected to be found (see Earl, 1983a, 1986). In general the threshold based demand function will not lead to the same equilibrium as the traditional approach. The demand curve will have small kinks, and kinks are likely to be larger for lower prices. Thus as we move downwards along the demand curve (price falls), the vertical segments representing complete insensitivity are becoming bigger.

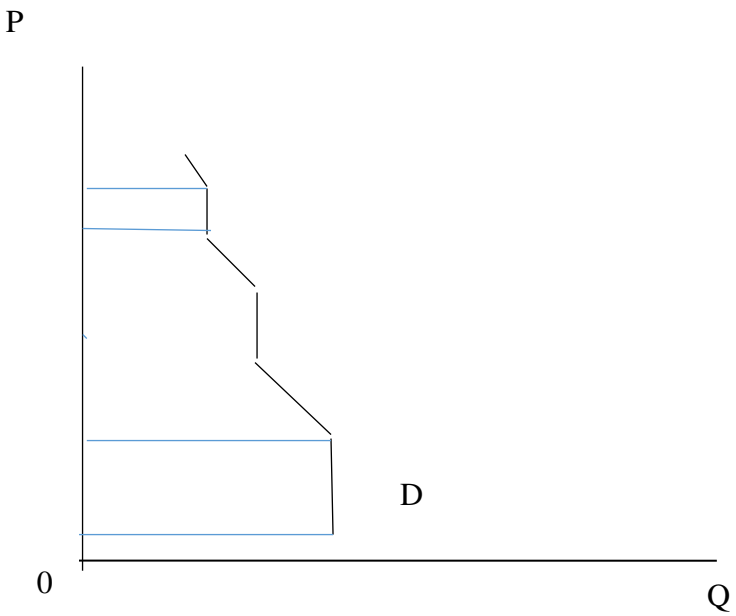

Figure 1

The above demand in figure 1 is a line of connected segments with varying angles of slope. It is likely to be like this when we consider categories of goods (e.g. clothing). However, it need not be so if we consider the case of a particular brand of product, whose demand might have a restricted domain. Specifically, above a particular point the consumer realizes the higher price and switches to a rival brand. This implies that prior to the switch-point price, the demand for the brand might be vertical (see also Okun, 1981 and Kornai, 1971). Thus the demand for a branded product is more likely to be a series of unconnected vertical lines implying that some price movements are completely ignored and others produce changes in the rate of purchasing.

In general, it is likely that the consumer will be much more sensitive (and thus the threshold will be smaller) at high levels of prices. Moreover the consumer is likely to be much less sensitive (large threshold) when prices are relatively low or are perceived to be low.

A good approximation of the above situation will be a demand curve which will be more elastic for prices higher than a certain price P_o, thus reflecting the agents' greater sensitivity. The demand will be more inelastic for prices lower than p_o, reflecting the agents' lower sensitivity. One could also view p_o as the appropriate price which agents expect for this particular good (Earl, 1986).

Earl's 'appropriate' price is similar to H. Hayes' approach who provides a pre-Sweezy treatment of the kinked demand curve. Hayes maintained that "the habit of paying a certain price for a particular good tends to make the demand for it elastic above the usual price, since customers may regard an increase in a long established price as being so unreasonable that they will refuse to purchase the good at a higher price" (Hayes,1928 and Reid,1981,pp.2-3). Clearly there is a similarity with what Earl calls "rip-off avoidance" (Earl, 1986, pp.260-62).

Having the above in mind the demand curve is likely to be as follows:

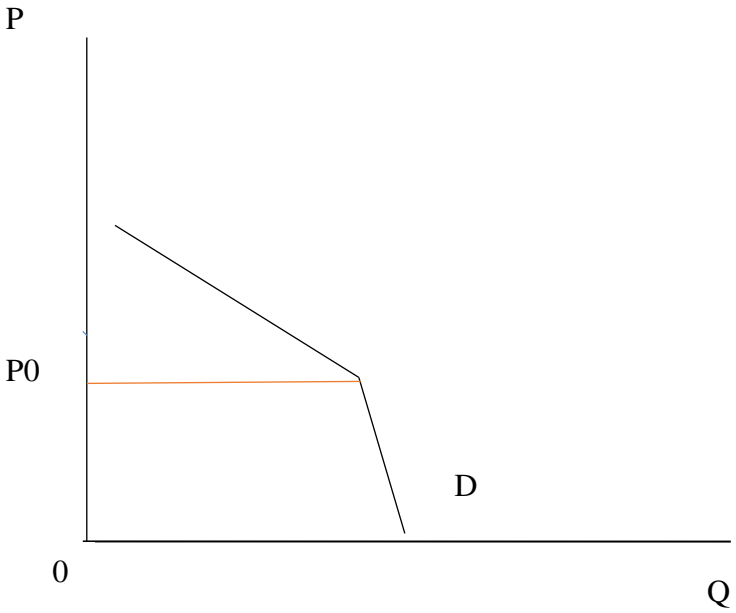

Figure 2

The implication here is that because of the threshold effect, a price rise will induce a more elastic response than a price cut and the demand curve will be kinked at the existing price.

4. Effects on Market Demand

The main idea of this section is that the individual kinked demand curves are likely to have an impact on market demand. Even if it assumed that only part of the population is characterized by this sort of threshold behaviour, it is still likely that the

total market demand will be kinked. In particular we saw that threshold behaviour deviates from the standard utility maximizing behaviour which is the behaviour of the rational agent in economic theory. Akerlof and Yellen have shown that even small deviations from the standard Neoclassical agent can have first order consequences. They demonstrate that non-rational (in the Neoclassical sense) behaviour leads to changes in equilibrium (relative to equilibrium with full maximization) which are first order, that is, they vary proportionately with the shift parameter (Akerlof and Yellen, 1985). This is reinforced by the fact that the impact of the threshold conduct is found not to cancel out in the aggregate but rather to expand hyperbolically. Specifically, Devletoglou and Demetriou have applied the idea of threshold behaviour on location theory, and they have found that such behaviour expands hyperbolically (hyperbolic fan), (Develetoglou and Demetriou, 1967).

Having the above in mind if D_k is the kinked demand, D_n is the normal demand, then D is the total demand curve. See figure 3.

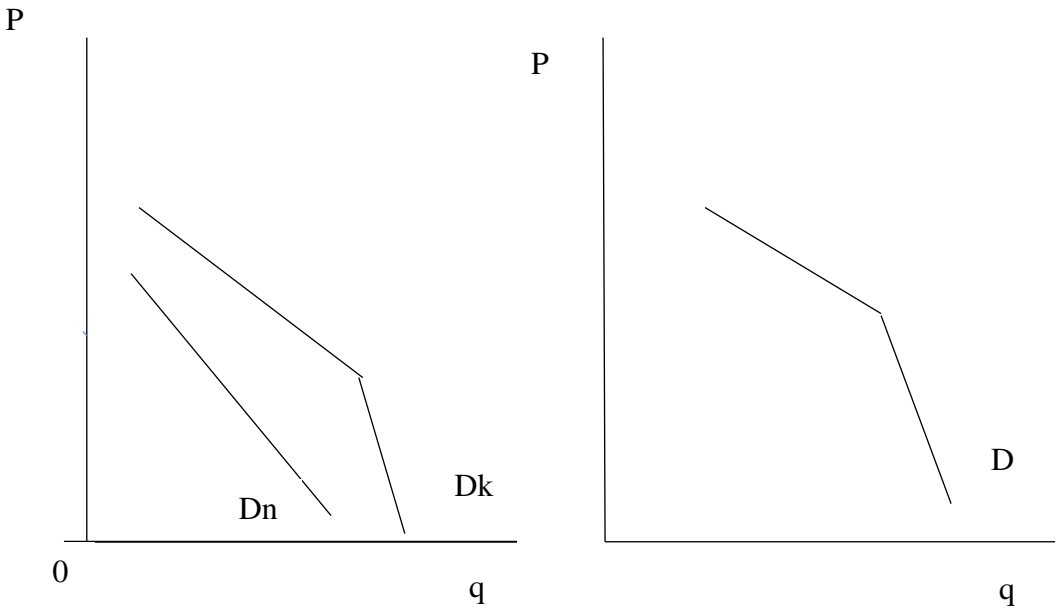

Figure 3

The total demand equation will be the standard kinked demand:

$$D = (q) \quad = \quad f'_1(q), \; q \leq \bar{q}, \; f'_1 < 0$$
$$= \quad f'_2(q), \; q \geq \bar{q}, \; f'_2 < 0$$
$$with \; f'_1(q) > \; f'_2(q)$$

(For an extensive technical discussion of the kinked demand curve see Reid, 1981).

One can still argue that there is a possibility that the kinks will cancel out in the aggregate if we take into account the different points at which the threshold occurs. One can however, maintain that it is quite possible that the threshold levels might be similar for certain categories of goods (necessary and luxury goods) for large groups of the population with similar incomes (see Georgescu-Roegen, 1966). More specifically, if we draw from Maslow's theory of needs we might establish a connection between the hierarchy of needs and categories of goods (Maslow, 1954). In this framework, the basic needs can be satisfied by a certain category of goods (necessary), and higher needs are satisfied by other categories of goods (Lutz and Lux, 1979, 1988). Thus the ideas of categories of goods corresponding to categories of needs reinforces the possibility of the existence of kinks.

Some economists like P. S Andrews and P. Earl have emphasized the importance of commodity grouping for demand theory (Andrews, 1950, Earl, 1983a). In particular, Andrews maintains that there are price bands corresponding to different groups of consumers (Andrews, 1950). For example, a relatively low income group expects a product to be at a particular price band, a high income group at another (this point is also relevant to the idea of appropriate price discussed before). Thus there is a market segmentation implied here which is related to differences in conventional budgets. (Conventional budgets might be socially defined). Consequently, market segmentation can be viewed as an additional reason for the existence of kinks in the

demand curves. An additional point which is worth mentioning is that the existence of price bands enforces firms to engage in non-price competition (i.e. differences in quality).

Before we proceed though it should be emphasized that the above notions of goal achievement, market segmentation, and price bands, inevitably lead us to the important idea of social norm and social defiance. More specifically, there is a difference between a cognitive threshold and a social norm (for a discussion of social norms see Earl, 1983b). However, it can be argued that observers may experience threshold effects as they consider whether someone is behaving according to the social norm. Moreover, this implies that people engaging in socially appropriate conduct, need to have an idea of the thresholds of others. [1]

Related to the above is the notion of deviant behaviour which brings some important dynamic implications. First, a clear-cut definition of deviant behaviour requires that social bounds are clear. A possible way of the operation of social norms (and thus of the nature of deviant behaviour) is that people learn the upper and lower limits of social tolerance by simply breaking them. The breaking of the limit is noticed by the reference group and deviant behaviour is discouraged by it. Thus, learning by doing seems to be a central idea here (Earl, 1986; 1990, pp.732-35). Furthermore, since we are dealing with social limits and their perception, the threshold effect operates in the whole process. There is also the possibility that conflicting social pressures on an individual might be responsible for the difficulty of strict adherence to particular social bounds, and thus his or her behaviour is likely to oscillate. [2]

As an application of the above in the case of the consumer, one can argue that there is a common perception of the "appropriate" price for commodities which are consumed by people of similar incomes. Large deviations from this price through conspicuous (or inconspicuous) consumption are discouraged by the mechanism of

social conformity. Social influence can be seen here as a social pressure to conform thus enforcing consumption behaviour to stay inside the socially acceptable limits ("social threshold"). As Jones states "agents take actions mindful of what the other group members will think of them as a result" (Jones, 1984, p.36). Jones gives a specific example of social conformity in workers' behaviour (Jones, 1984). However, it should emphasized that Jones confines this idea to the workplace, while this paper is concerned more with the wider implications of conformist behaviour. In general, in the case of demand curves, social conformity might be seen as an additional reason for making the existence of kinks in the aggregate more probable.

Before closing this section, we should point out that the threshold effect in connection with social norms, can also apply to factor demand. The demand for a particular input for instance, might be kinked if we accept the notion of appropriate price. The demand for labour might be more elastic for wages above a given w_0, and less elastic for wages below this level. There is also ground for the application of the same idea to the theory of factor supply and in particularly to labour supply. It can be argued that there exists a "normal" level of money wage. If the money wage is reduced below this normal level the effect on labour supply might be very significant. In other words the labour supply curve is more elastic below the "normal" wage. This is similar to Keynes's idea about wage rigidity (see also Trevithick, 1975).

5. Possible Testing and Some Macro Implications

One can test for kinked market demand curves by incorporating some econometric methods which are used for testing asymmetric responses. In particular, the symmetric demand equation (ignoring random disturbances) is:

$$q_t = a_o + b_o p_t$$

where q_t is the quantity bought at time t and p_t is the price paid. Following the Wolffram approach, the asymmetric demand equation can be written:

$$q_t = a_1 + b_1 WR_t + b_2 WF_t$$

where WR_t is the sum of all period-to-period rises in P_t, and WF_t is the sum of all period-to-period falls in P_t:

$WR_t = \sum_{i=1}^{t} \Delta PRt$ and $WF_t = \sum_{i=1}^{t} \Delta PFt$

where $\Delta PR = P_1 - P_{i-1}$ if $P_i > P_{i-1}$ and =0 otherwise;

and $\Delta PF = P_1 - P_{i-1}$ if $P_i < P_{i-1}$ and =0 otherwise.

A number of authors have used the above Wolffram method in order to test for asymmetries in various goods (see Wolffram, 1971, Houck, 1977, Young, 1980 and Rutherford et al. 1985).

The threshold effects have also a number of theoretical implications at the macro level. Before we concentrate on a specific issue, (price rigidity), we will provide some brief general comments for further research. First of all, Behrend's idea on frames of reference in evaluating price and income fluctuations is analysed with connection of incomes policy. Peoples' conception of current price and income levels (affected also by the threshold effect) can have significant implications for the success of incomes policies: people might perceive a real increase in income as a real income reduction due to the increase in prices (see Behrend, 1984). Related to this is the idea that mainly because of the threshold effect, consumers cannot easily distinguish relative price changes from absolute price changes. According to Deaton this confusion will result in an increase in savings in the short-run (until consumers sort things out). This has important consequences for real consumption and thus (assuming stable real income) for the saving ratio. In the long-run people accumulate

evidence about the real movement of variables and the previous expenditure will be restored (Deaton, 1977).

Threshold effects are also relevant when it comes to expectations. Good examples are the impact of a currency devaluation, and also news about financial institutions and firms. For instance, one could think in terms of a kinked demand for bank deposits by referring to the concept of appropriate price (interest in this case) that we saw before. The impact on financial markets can also be connected with the resilience of expectations which might be also due to threshold reactions. As an example, one can note Leijonhufvud "corridor" concept which provides an explanation of why demand failures do not always lead to multiple departures from an economy's evolutionary path (Leijonhufvud, 1973). Minsky's theory about financial crises might also be connected with the threshold notion. In particular, according to Minsky one of the main reasons for financial fragility, is the financial-market reactions to a fall in firms' "margins of safety": their reactions further decrease these margins (Minsky, 1986, pp.213-220). There is scope for connection here, since the financial-market perceptions of the levels of the safety margins can be influenced by the threshold effect.

One can also use the threshold-based demand curve, as an additional explanation for price sluggishness. Taking the market threshold-based demand of figure 3, we can see the price inertia in Figure 4:

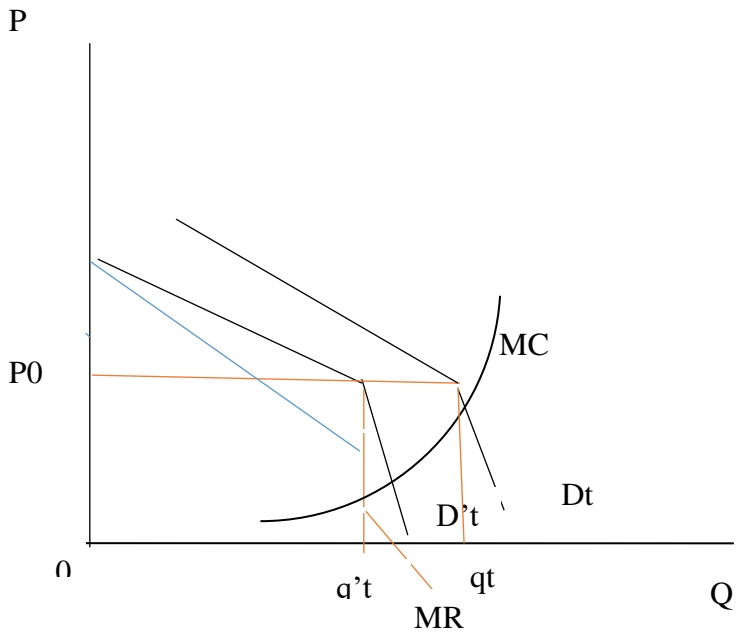

Figure 4

A fall in demand due to a recession will cause a shift to the left from D_t to D'_t. It is likely that the angle of the demand curve will remain at the same point (Drakopoulos, 1992). It is also likely that because of the vertical MR, the firm will hold its price at P_o while quantity demanded will fall from q_t to q'_t. Some theorists like Smith and Neale maintain that in the general case of the kinked demand, the marginal cost must always pass through the Marginal Revenue gap (see Smith and Neale, 1971 and for a general discussion of the macroeconomic implications of kinked demand curves see Blanchard and Fischer, 1989).

It can also be observed that in the special case where the firm has a fixed output capacity, the above example of price rigidity can result in a positive excess supply $q_tq'_t$. Obviously this implies a non-market clearing situation.

5. Conclusion

The starting point of this paper was the idea of the kinked demand curve. It was shown that if one is willing to relax the assumption of a perfectly utility maximizing economic agent, then the possibility of threshold sensitive behaviour appears. This kind of behaviour has a strong support in psychology where it is known as the Weber-Fechner Law. The incorporation of this law into demand results in a multi-kinked demand curve which can be approximated as a kinked demand of the Sweezy type. It was also suggested that mainly because of the grouping of goods and of social conformity, it is very likely that the resulting market demand will be kinked too. In terms of macroeconomic significance, the threshold effect can be connected with income policies, saving behaviour and expectations in the money markets. Moreover, the market threshold-based demand can be seen as an additional explanation of price rigidity. This is a common result of kinked demand curves originating from other approaches like imperfect market structure or informational asymmetries. The difference here however, was that the explanation came from the idea of psychological threshold. In addition, the paper suggested a possible econometric method for testing kinks in the demand curves.

Endnotes

1) and 2) I am grateful to an anonymous referee for these points.

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